T1 Preliminary Treatment/ Septage and Other Liquid Hauled Wastes

This chapter describes those processes, generally at the head end of the wastewater treatment plant, that are designed to remove material from the wastewater to protect equipment and processes downstream. The preliminary treatment processes described in this chapter are screening, comminution, grinding, and grit removal. A section is also included on design and handling considerations for preliminary treatment of septage and other hauled wastes delivered to wastewater treatment plants for treatment and disposal.

Tables

T1-1 Preliminary Treatment

T1-1.1 Scope and Objectives

Preliminary treatment processes include screening, comminution, grinding, and grit removal. These processes remove or change those materials that may foul or wear out pumps and plug piping and process units. Flow equalization, flow measurement, flow sampling, chlorine addition, and odor control are also included in this chapter because these are generally located at the head end of the plant.

T1-1.2 Screening

Screens should be placed in the influent flow at the head end of the plant to remove debris that may harm other process units. Ecology requires that this material be removed, and a screening device meets this requirement.

T1-1.2.1 Introduction

Screen size openings vary from 2 to 3 inches in coarse screens to .008 inches in very fine screens. The type of screen chosen for the plant depends on the downstream processes and how the plant’s biosolids program is managed. The main advantage of screens over grinders is that they remove incompatible objects from the wastewater stream.

Generally, wider openings are used to protect plant equipment and smaller screen openings are used to actually treat wastewater, sometimes eliminating the need for primary treatment. Wider, coarse screens are always used ahead of plant process units such as influent pumping and grit removal. Smaller, finer screens can be used before or after influent pumping. Some screens cannot handle rocks, so rock removal must be considered separately in the design. Another important part of screen design is handling the screened material and its disposal. Disposal availability and costs may influence screen size.

T1-1.2.2 Coarse Screens Including Bar Racks

Coarse screens are at the head of process equipment to protect the equipment from being damaged by debris found in sewage flows, or are used in bypass channels. Openings in the screens generally range from one-half to 3 inches.

A. Manually Cleaned

Manually cleaned bar racks or screens have larger openings (one and one-half to 3 inches) and are used to protect equipment or are placed in bypass channels. The larger openings reduce head loss but are labor intensive. These screens should be designed with a way of ensuring sewage overflow should the screen become plugged when no operator is available. A high-water alarm in front of the screen will alert operators that the screen needs raking. The bars are typically set at 30 to 45 degrees from vertical to facilitate cleaning. The top of the screen should have a perforated plate or continuous bars to drain the debris after removal and before being placed in a dumpster. The bars should be designed to be removable so they can be cleaned when rags build up behind them.

B. Mechanically Cleaned

Mechanically cleaned coarse screens have smaller openings (one-half to one and one-half inches) and are used to remove unwanted solids from sewage. These smaller openings create head loss that must be accounted for in the channel design. There are many ways that mechanical screen bars can be cleaned. Generally, the more moving parts that contact the sewage the more maintenance the unit will take because of the abrasive grit in sewage. Some screens are designed to also remove rocks as well as debris.

T1-1.2.3 Fine Screens

Fine screens are used to remove very fine materials such as plastics and cigarette filters from sewage, or they can be used in place of primary clarification. These screens have a large head loss, which must be accounted for in the design. The volume of material removed by these screens, including fecal material, should be taken into consideration during design.

A. Mechanical Bar

Some bar screens are made with an opening as small as one-quarter inch. The bars are set from 0 to 30 degrees from vertical. These smaller-opening screens are susceptible to rock damage so the design should place rock removal ahead of the screens.

B. Rotary Drum

Rotary drums are very efficient in removing small debris from the wastewater; however, because they are prone to grease plugging, the amount of grease in the wastewater should be taken into consideration.

C. Static

Static screens have no moving parts and must have flow pumped to the top of the screen. The material left on top of the screen as the flow passes through is removed from the screen by gravity. These screens have the smallest openings and are sometimes used instead of primary treatment. They have also been used to remove solids when cleaning digesters.

T1-1.2.4 Screen Design Criteria

If the screens are placed in a building or a deep channel, the area must be designed for adequate explosion-proof equipment and ventilation to control odors. A screenings building should be separate from other plant processes. All screening devices must have a backup screen or bypass channel. Each screen channel needs to be able to be isolated and have provisions for dewatering for maintenance. Channel design for bar rakes should take into consideration whether the rake will remove rocks or is susceptible to rocks.

Adequate clearance and water for cleaning the equipment must be addressed in room design. Motors on mechanically cleaned screens need to be waterproof if they have a chance of being submerged during a high flow condition or electrical loss. Maintenance can be reduced on bar screens by activating the rake only when the screen becomes blinded. Generally, screens have a timed sequence and a channel head differential to activate the rakes. All screen devices must have a local control switch so they can be taken off automatic mode and operated manually or locked out for maintenance.

Manufacturers of screens will recommend flow velocities for their equipment. Velocities generally are 1 to 3 fps at the average flow rate. Velocities are calculated from a vertical projection of the screen openings on the cross-sectional area between the invert of the channel and the flow line.

T1-1.2.5 Screenings Handling Equipment

The design of screenings handling equipment will be dictated somewhat by disposal practices. Landfill practices are changing, and some landfills do not accept material containing free water or fecal material. Screenings disposed of through a transfer station may require additional considerations.

A. Belts and Dumpsters

Screenings may be moved to a dumpster by belts. The belts will need to be cleaned, so a nearby wash station should be included in the design. Because screenings in the dumpster will generate odors and attract insects, enclosing the dumpster should be considered.

B. Washers

Screenings from screens with half-inch or smaller openings will contain fecal material. There are several washers on the market that will remove fecal material from the screenings. Most washers are combined with compactors that remove excess water from the rags.

C. Compactors

Compactors, when used with screenings, will remove excess water so landfills will accept the waste. If the compactor is placed outside, the discharge tube should be heat-taped and insulated. Large amounts of rock in screenings will cause binding problems in the discharge tube. Flushing or an alternative means of dewatering should be considered.

D. Design Considerations

Most screenings storage will produce odors, insect problems, and drainage. Odor control and proper ventilation should be addressed in all storage container siting decisions. Dumpsters that receive screenings should have a way to be dewatered with a floor drain to the sanitary sewer, as close as possible to the dumpster. Drainage from dumpsters may damage concrete floors because of acidity, so the floor should have a protective coating. A cleanup station should be in the immediate area for cleaning when the dumpster is picked up. Redundancy or another method of screenings handling should be considered in case of equipment failure. Because screenings and storage rooms have corrosive atmospheres, all equipment should be of noncorrosive design.

T1-1.2.6 Screenings Disposal

Disposal of screenings is the most critical design consideration. Most landfills cannot accept waste that contains free water. Some will not accept waste with visible fecal material. The design of the dumpster box and the type of screen handling will be dictated, in most cases, by these landfill requirements.

Estimated screenings quantities and landfill acceptance shall be confirmed prior to design.

T1-1.2.7 Safety Considerations

If any equipment used in the screening process has a tendency to spill water or product on the floor, a decision must be made whether to design the floor with a smooth surface for ease of cleaning or a rough surface so employees do not slip. A designer should consider a smooth surface under machinery sloping to drains and nonskid surfaces in traffic areas. All areas need adequate ventilation to keep odors and moisture at a minimum. The building design should address the explosive atmosphere surrounding screens and related equipment inside buildings.

T1-1.3 Grinders and Comminutors

Grinders and comminutors reduce the size of particles or debris in wastewater to three-quarter-inch or smaller, but do not remove this material from the flow.

Channel units must have a way to isolate the channel for maintenance. The channel should also have a means of dewatering for worker entry. Design of the drain must take the amount of grit in the wastewater into consideration. Velocity in the channel should be a minimum of 2 fps to keep grit moving. If the grinders or comminutors are installed in a room, they should receive the same considerations given to bar screen design.

T1-1.3.1 Grinders

Slow-speed wastewater grinding equipment typically has two sets of counter-rotating blades, which trap and shear the solids into quarter-inch particles. These grinders can usually handle small rocks and, if jammed, reverse to clear. Grinders generally do not cause roping and rag balls to form. If combining grinders with a pump, it is better to put the grinder on the suction side of the pump. Grinders have also been used in sludge lines to grind up plastics so the biosolids will not contain any noticeable debris. A bypass line will need to be installed for each unit. These units contribute some head loss, which must be accounted for in the hydraulic design. Manufacturers can provide appropriate design data.

T1-1.3.2 Comminutors

Comminutors are susceptible to rock damage, so rock sumps or screens should be installed upstream. These units need redundancy or a bypass channel with screening. Improperly maintained cutters on the comminutors cause string-like material to pass to other process units, which may form ropes or balls of material that can clog equipment. It is not advisable to place comminutors ahead of biotowers or trickling filters because of plugging problems. Grinders generally do not cause these problems because most are designed to grip and tear up the material.

T1-1.3.3 Safety Considerations

Comminutors and grinders should have a local, manual, and lockout switch for jamming or maintenance of the equipment. Open channel design must consider odor and explosive atmosphere if the units are installed inside buildings.

T1-1.4 Sampling and Flow Measurement

Ecology requires that flow from a wastewater plant be accurately measured and sampled. Design of the headworks must include provisions for the accurate measurement of flows and the ability to collect a representative sample of a treatment plant's influent. It is recommended that a continuous recording of flows be maintained.

T1-1.4.1 Introduction

Flow components must be measured and sampled at wastewater plants throughout the process units for compliance, operational control, and future expansion data. Designers need to look closely at sampling locations to make sure samples are representative. It is best to place samplers close to what is being sampled because sample lines tend to develop growths that may alter the sample.

T1-1.4.2 Flow Measurement Location

Measurement devices must be placed where recycle flow streams will not affect the measurement, if possible. In open channel measurement, consider the unit processes before and after the measuring device. A backup from a downstream process unit may cause a high reading at the flow-measuring meter. Likewise, equipment upstream that causes surges or uneven flow across the channel will be difficult to measure.

T1-1.4.3 Flow Measurement Methods

Provisions need to be made for flow measurement in open channels, enclosed pipes, and levels in tanks. See Chapter G2 for additional information on flow and level measurement.

T1-1.4.4 Flow Sampling Design Considerations

Flow samplers must meet certain requirements and sampling must be done in such a manner that accurate flows and levels are measured. See Chapter G2 for additional information on flow sampling.

T1-1.5 Grit Removal

T1-1.5.1 Introduction

Grit chambers are provided to remove coarse inorganic solids such as sand, cinders, rocks, cigarette filter tips, and heavy, inert, organic solids such as coffee grounds and fruit seeds from flow. Grit may be removed by settling in square, rectangular, or circular chambers or by centrifugal force. Grit removal protects equipment by:

- Reducing clogging in pipes;
- Protecting moving mechanical equipment and pumps from abrasion and accompanying abnormal wear;
- Preventing accumulations of material in aeration tanks and digesters or other solids-handling processes that result in loss of usable volume; and
- Reducing accumulations at the bases of mechanical screens.

Grit chambers should be generally designed to remove grit of 65-mesh size and larger.

Grit removal facilities should be provided for all sewage treatment works unless there is evidence to indicate the grit in the wastewater will not cause an operation and maintenance problem or the sewage will flow directly to a lagoon.

Grit removal may be accomplished by primary settling tanks when grit removal is not provided in preliminary treatment. Refer to the requirements in T2-2.2.5 and T2-3.2.6.

See G2-7 for safety considerations.

T1-1.5.2 Aerated

Aerated grit chambers provide a period of wastewater detention to trap grit through air-induced rotation of the wastewater at approximately 1 fps. Aerated grit chambers should be sized to provide a detention time of 3 to 5 minutes at the peak-design flow. Air requirements vary, depending on the basin geometry and wastewater characteristics. Typically 1 to 5 scfm of air per foot of length is required for proper aerated grit operation. Skimming equipment must be provided in aerated grit chambers if the outlet is below the water surface. For typical operating requirements and results, see Table T1-1.

Table T1-1. Requirements for Aerated Grit Removal Chambers and Typical Results

Parameter	Typical Operating Ranges
Transverse velocity at surface	2 to 2.5 fps
Depth-to-width ratio	1.5:1 to 2:1
Air supply	3 to 5 cf per min/ft 0.04 to 0.06 cf/gal
Detention time	3 to 5 min peak
Quantity of grit	1 to 10 cf/mil gal
Quantity of scum (skimmings)	1 to 6 cf/mil gal

T1-1.5.3 Vortex

Vortex grit chambers are gravity-type chambers that swirl the raw wastewater in the chamber. The inorganic matter settles to the tank hopper section and the organic matter remains in suspension where it is carried out by the tank effluent. Some vortex tank designs rely on natural hydraulics to achieve the proper rotational rate. Other designs use natural hydraulics and a slow, rotating paddle-type mixer to achieve the proper separation. The grit that settles in these tanks can be removed by an airlift pump or a nonclogging, recessed propeller-type pump. The grit removed from these tanks can be transferred to a grit dewatering channel, cyclone degritter, grit classifier, or other grit-handling equipment.

T1-1.5.4 Horizontal Flow

Horizontal-type chambers should be designed to control the flow-through velocity to approximately 1 fps over the entire flow range. A Sutro weir or other proportional weir is normally used to control velocities for rectangular channels. Parshall flumes are used to provide uniform velocity distribution with parabolic-shaped channels. Length of the channels depends on the size of grit to be removed and the maximum depth for flow. On the basis of a grit specific gravity of 2.65, settling velocities would be 3.7 fpm for 65-mesh and 2.5 fpm for 100-mesh grit.

Grit can be removed mechanically or manually. Mechanically cleaned grit chambers are recommended for plants with greater than 2.0 mgd average design flow. Two grit chambers should be provided, each designed for peak design flow.

T1-1.5.5 Hydrocyclone

Cyclone degritters use centrifugal force in a cone-shaped unit to separate grit from the wastewater. A pump discharges a slurry of grit and organics into the degritter at a controlled rate. The slurry enters the degritter tangentially near its upper perimeter. This feed velocity creates a vortex that produces a grit slurry at the lower, narrower opening and a larger volume of slurry containing mostly volatile material at the upper port. The grit stream falls into a rake screen washer. The degritted flow leaves the cyclone through the opening near the top of the unit, moving downstream for further treatment. In some systems, a mechanical mixer induces the centrifugal effect.

The cyclone degritting process includes a pump as an integral part of the process because the cyclone has no moving parts and depends on a steady supply of liquid. The volume of pumped slurry and the resultant pressure at the degritter are critical requirements specified by the cyclone manufacturers. The temperature, solids concentration, and other characteristics of the slurry may require changes in the sizes of the upper and lower orifices after installation and some initial operating experience. In some designs, the orifices are manually adjustable. The grit flow stream from the cyclones should be washed before final disposal.

T1-1.5.6 Grit Removal Design Criteria

A. Location

Grit chambers may be located ahead of or after comminution. Rock traps must be provided ahead of comminutors if the grit chambers follow comminution. Grit chambers located upstream of comminutors should have coarse bar racks preceding them. Grit removal should be installed downstream of the screening devices to prevent clogging of grit aeration diffusers and other problems associated with rags and other trash in the wastewater. Whenever possible, grit removal facilities should be located in open areas with easy access.

B. Number of Units

For large treatment plants, at least two units should be provided for grit removal facilities. However, for small facilities (less than 2 mgd average design flow), only one unit may be installed, with provisions for bypassing.

C. Inlet

The inlet should be carefully designed to minimize turbulence so the flow is evenly distributed among channels and does not promote “dead spots.”

D. Drains

Provisions are required for dewatering each unit. Drain lines should discharge to points within the system such that the contents of the drained units received maximum treatment.

E. Flow and Internal Effects on Grit Removal Efficiency

Flow rates and short-circuiting are two factors that may affect the performance of grit removal systems. When designing a grit removal system, it is important to consider these factors and provide control devices to regulate the wastewater velocity at approximately 1 fps and baffling as a way to control short-circuiting.

F. Grit Removal Control Systems

Either a computer system or the operators at the facility may provide control of the grit removal system. Both require an operator to determine the proper grit removal for the facility to achieve peak performance of the grit removal system.

T1-1.5.7 Grit Handling

Impervious surfaces with drains should be provided for all grit-handling areas. If grit is to be transported, conveying equipment should be designed to avoid accidental leakage or loss of material.

Grit storage facilities are often the source of odor and grease accumulation. Clean grit can help minimize odor and extra-large drains can prevent grease from clogging floor drains. Drain flows shall be routed back into the plant for treatment.

When unwashed grit must be transported, the utility may have to provide odor control during transportation. Grit disposal by landfill or burial with capacity for disposing of 1 cu yd/day/mgd shall be provided. Grit should not be introduced into the treatment or digester units.

A. Inclined Screw Conveyors

Inclined screw conveyors remove the grit from the sump and drop it into a classifier or washer that removes most of the organic matter collected with the grit. In larger plants with wider channels, screw conveyors move grit to a central sump.

B. Chain and Buckets

Most rectangular grit tanks have a chain-and-flight mechanism to move the grit to a sump. A bucket elevator removes the grit from the sump and drops it into a classifier or washer that removes most of the organic matter collected with the grit.

C. In Deep Pits

Grit removal facilities located in deep pits should be provided with mechanical equipment for pumping or hoisting grit to ground level. Such pits should have a stairway, elevator, or lift and shall have adequate ventilation and lighting. Mechanical and electrical equipment in deep pits should be submersible and explosion-proof.

D. Pumping

Air lift pumps are preferred to pump the grit to a classifier or washer that removes most of the organic matter collected with the grit.

T1-1.5.8 Grit Washing/Dewatering

Grit washing effectively removes organics from the grit. Screw and rake grit washers have proved to be reliable and usually produce a material low in organics. To ensure a low volatile content, however, ample dilution water may be required. Pumps normally provide sufficient dilution water, but bucket elevators may not, especially during periods of peak grit capture. Consequently, they may require supplementary liquid to function properly.

T1-1.6 Odor Control

Odors are released at the headworks of a plant, particularly at points of turbulence. Preventing or controlling these odors is important in preventing complaints from neighbors, providing a reasonable working environment, and avoiding corrosion of the equipment. See Chapter G2 for detailed information on odor prevention and treatment.

T1-1.7 Flow Equalization

Flow equalization is an optional process used to accommodate wide variations in flow rates and organic mass loadings.

T1-1.7.1 Introduction

Flow equalization's primary objective is to dampen the diurnal flow variations and as a result achieve a nearly constant flow through the series of treatment processes. A secondary objective is to dampen the concentration of wastewater loadings and provide a more uniform concentration of organics, nutrients, and other suspended and dissolved constituents.

Flow equalization should be provided for treatment plants that may experience unusual flow variations that affect process efficiency, such as large commercial or industrial facilities.

In addition, flow equalization should be a consideration for many advanced wastewater treatment operations, such as filtration and chemical clarification, which are adversely affected by flow variations and solids loading.

Equalization basins are typically placed after the screening and grit facilities and before the primary tanks; however, they can be placed at other locations within the treatment process. In some instances, the large interceptors entering the treatment facility can be used as an effective storage basin to dampen the diurnal flows. See Chapter C3 for additional information.

T1-1.7.2 Types

Equalization basins are designed either in-line or side-line. For an in-line design, all flow passes through the basin and results in significant flow and concentration dampening. In the side-line design, only flow exceeding the average daily flow is diverted into the basin. This type of design will dampen flow but not necessarily dampen the pollutant concentrations.

T1-1.7.3 Design Considerations

Design of an equalization basin should incorporate the evaluation and selection of a number of features, as follows:

- In-line versus side-line basins.
- Basin volume.
- Degree of compartmentalization.
- Type of construction (earthen, concrete, or steel).
- Aeration or mixing equipment.
- Pumping and control concept.
- Degree of flow modulation desired.

The design decision should be based on the nature and extent of the treatment processes used, the benefits desired, and local site conditions and constraints.

A. Basin Volume

Sufficient basin volume should be provided to allow those parts of the treatment process that follow storage to operate equal to or less than their rated design capacity. The first step in determining the amount of volume required is to determine the diurnal variation of the wastewater flow. This should be determined from actual flow data when available. Diurnal flow variations will vary from day to day, depending on many factors such as seasonal residences, commercial and industrial sources, etc. Additional equalization basin volume should be provided to accommodate the continuous operation of the aeration and mixing equipment, and unforeseen changes in the diurnal flow. Where data are not available, an evaluation of the infiltration/inflow should be conducted with a basin volume equal to 8 hours of the estimated daily maximum flow being provided.

B. Mixing Requirements

Proper mixing and aeration in an equalization basin will prevent the solids deposition and the contents from becoming septic. Mixing requirements for preventing solids deposition should range from 0.02 to 0.04 horsepower per 1,000 gallons of storage volume. To maintain aerobic conditions in the basin, air should be supplied at a rate of 1.25 to 2.0 cf/min per 1,000 gallons of storage.

Mechanical aerators are a typical method of providing mixing and aeration to a basin. Provisions such as low level shutoff and supports for the unit when the basin is dewatered should be provided.

Mixing requirements often exceed the requirements for oxygen and in such cases it may be advantageous to provide both a mixing and a diffused aeration system. The diffused aeration system can be either a fine or coarse bubble type system. Ceramic diffusers are not recommended because of possible biological slime growth and inorganic deposits that can cause clogging.

C. Flow Control

The design shall provide for multiple pumping units capable of delivering the desired flow rate from the equalization basin with the largest unit out of service. Gravity discharge from equalization basins shall be regulated by an automatically controlled flow-regulating device.

A flow-measuring device shall be provided downstream of the basin to monitor and control the equalization basin discharge. Instrumentation should be provided to control the discharge rate by automatic adjustment of the basin effluent pumps or flow-regulating device.

Basins used for waste strength equalization generally require constant volume and may require pumping into the basin with a variable outflow equal to the influent flow.

D. Basin Dewatering and Cleaning

All equalization basins should have provisions for dewatering. Facilities shall be equipped to flush solids and grease accumulations from the basin walls as well as withdraw floating material and foam. Bottoms of basins should be sloped to facilitate dewatering and cleaning. A sump could also be installed to facilitate these processes.

T1-2 Septage and Other Liquid Hauled Wastes

This section provides guidelines for the design and handling of septage and other hauled waste at wastewater treatment plants. Introducing these wastes into treatment works places demands on the processes that are disproportionate to typical hydraulic and organic loadings. Smaller systems need to be aware, **before** they accept septage, that a single load of septage may overload their processes and cause permit violations. Treatment system operators are encouraged to calculate the BOD and TSS loading for each anticipated load of hauled waste before accepting the waste.

T1-2.1 Scope

The term “septage” is used here to mean wastewater that is hauled to the treatment plant by trucks and discharged at a receiving station ahead of primary treatment. Although this wastewater is assumed to consist primarily of domestic septage, other types of waste are also possible. Some of the more common types are described below.

T1-2.2 Characterization of Waste

The general characteristics for the more typical wastes that may be hauled to a treatment plant are discussed below. Treatment plant officials should carefully evaluate the potential impacts of these characteristics on the capacities of their system.

T1-2.2.1 Septage

In many respects, septage is similar to domestic sewage, except that septage is significantly more concentrated.

A. BOD_5

The BOD_5 of septage can be as much as 30 to 50 times or more concentrated than normal domestic sewage. Although literature values for BOD_5 concentrations are available, the basis for design must be an assessment of the actual waste that is expected locally.

B. TSS

Compared to domestic sewage, septage can be very high in suspended solids (e.g., 10 to 50 times typical influent). Evaluation of solids characteristics of local septage waste is recommended and should include total solids (TS), total suspended solids (TSS), total volatile solids (TVS), and settleable solids.

C. Fats, Oils, and Grease

Almost no decomposition of grease occurs at a wastewater treatment works, and the expense of handling and disposing grease can be considerable. If possible, avoid allowing haulers to bring the contents of grease traps for discharge to a publicly owned treatment works. Rendering and other recycling options are often available and preferable to handling at a wastewater treatment works.

D. Grit

A household septic tank will accumulate grit, rocks, and other dense material in its sediment layer over the years. After cleaning many septic tanks, the accumulation of this sediment load in the septage hauling tank can be several hundred pounds. Because of this concern for downstream sedimentation, discharge into a wastewater collection system should be avoided.

The septage receiving station should have provisions for an adequate rock sump. Even with an adequate rock sump, dense grit can form a compacted layer in a sewer main after several years of routine septage discharge into the collection system.

E. Odor

Due to the anaerobic nature of a septic tank system and the mixture of organic materials, septage is probably one of the most offensive smelling domestic wastes. Design should include means to control these potential sources of offensive odor.

F. Nutrients

The concentration of nitrogen and phosphorus in septage is high compared to typical domestic wastewater.

G. Heavy Metals

Metals in septage may come from household chemicals, leaching of plumbing pipes and fixtures, and possible contamination from previous industrial loads hauled in the septage hauling truck. Because metals do not decompose and the interval between septic tank pumpings can be several years, metals tend to accumulate in septage.

T1-2.2.2 Chemical Toilet Waste

Materials from portable toilet facilities are commonly called chemical toilet waste. Portable toilets are pumped similarly to septic tanks and transported to a treatment works for discharge. Commonly a chemical is added to the portable toilet's holding tank to control odors. Because chemical toilet waste is similar to aerobic sanitary waste, it should contain less BOD_5, TSS, grease, grit, rocks, and odor than domestic wastewater. However, since there is little time for digestion and little turbulence in the holding tank, the amount of undigested paper may exceed that found in normal sanitary wastewater.

T1-2.2.3 Recreational Vehicle (RV) Waste

The characteristics of RV waste are similar to chemical toilet waste (see T1-2.2.2).

T1-2.2.4 Marine Holding Tank Waste

The characteristics of marine holding tank waste are similar to chemical toilet waste (see T1-2.2.2).

T1-2.2.5 Vactor Waste

Many sanitary sewer collection systems use vacuum maintenance equipment to clean sewer lines, catch basins, manholes, and pump station wetwells. Depending upon the source, the resulting composition of the vactor load can vary widely. A full vactor truck may contain materials from several different types of cleaning assignments. Any vactor spoils contaminated with wastewater should be properly treated and disposed.

If vactor wastes are received from sources other than sanitary sewers, these wastes need to be characterized before being accepted.

T1-2.2.6 Waste from Other Wastewater Treatment Works

Waste received from other wastewater treatment facilities must be assessed on a case-by-case basis.

T1-2.2.7 Marine Bilge Water

Bilge is water that has accumulated in the hulls of marine vessels. Depending on the location of the vessel, the bilge volume may be either fresh water or salt water. Contamination of the water can come from deteriorating or rusting hulls and spills aboard the vessel, and is difficult to reliably typify from ship to ship. Individual characterization of bilge water is necessary for each reception.

T1-2.2.8 Water from Soil Remediation

A requirement to clean contaminated soil is becoming an increasingly frequent practice in restoring industrial and commercial properties. Water that is the byproduct of the soil remediation process (mostly ground water) is often discharged to a treatment works by a tank truck. The regulatory mechanism for receiving this hauled waste is often a discharge authorization issued by the industrial pretreatment program.

T1-2.3 Waste Design Criteria

The decision to treat septage flows as a part of the conventional municipal treatment process has several significant effects.

- Treating septage flows increases the load on both the liquid and solids stream treatment systems with resulting increases in operating costs, solids production, solids handling, and utilization costs.
- Accepting this loading consumes a greater proportion of the capacity than similar volumes of normal sanitary flow.
- Treating septage flows can affect the ongoing operation and, ultimately, the quality of effluent and biosolids produced at a given facility.

WEF Manual Of Practice No. 24 and other references provide ranges of design values. Although literature values for BOD_5 and other waste constituent concentrations are available, assessment of the actual waste that is expected locally must be the basis for design.

Design of the treatment plant process must account for septage loading as a part of the complete design. The design criteria used to provide for septage receipt shall be listed on the plans, as required by WAC 173-240-070. Loading assumptions and design criteria for septage receiving should be indicated separately, under a septage heading, in addition to the agglomerate loading assumptions. Minimum waste criteria which need to be addressed are as follows:

T1-2.3.1 BOD_5

Strength of BOD_5 from septage ranges from 500 mg/L to more than 75,000 mg/L. The designer is responsible for determining anticipated loadings. Loading values must be supported by calculations and assumptions. The design criteria should indicate what rate in pounds per day will be assumed from septage, and what period during the day this will be applied. This calculation will need to be added to the other BOD_5 contributions addressed in the plant process design.

T1-2.3.2 TSS

Strength of TSS from septage ranges from 1,100 mg/L to more than 90,000 mg/L. The designer is responsible for determining anticipated loadings. Loading values must be supported by calculations and assumptions. The design criteria should indicate what rate in pounds per day will be assumed from septage, and what period during the day this will be applied. This calculation will need to be added to the other TSS contributions addressed in the plant process design.

T1-2.3.3 Fats, Oils, and Grease

The amount of fats, oils, and grease in septage ranges from 200 mg/L to more than 20,000 mg/L. The designer is responsible for determining anticipated loadings. Loading values must be supported by calculations and assumptions.

The design criteria should indicate what rate in pounds per day will be assumed from septage. This calculation will need to be added to the other fats, oils, and grease contributions addressed in the plant process design.

T1-2.4 Receiving Facility Design Criteria

Design of the receiving station requires addressing several areas of concern. These include how the odors will be controlled; how preliminary treatment will remove rocks, rags, and plastics; and how equalization of the flow will be achieved. In addition, designers should address how to control access, identify septage dischargers, and measure septage discharge volumes. When answering these questions the cost impacts specifically attributable to the septage operation should ultimately be reflected in the septage treatment charge. See EPA's "Technology Transfer Handbook—Septage Treatment and Disposal," Chapter 4, 1984 (or latest revision) and WEF's "Manual of Practice No. 24," 1997 (or latest revision), for additional design concerns.

T1-2.4.1 Storage Volume

Septage holding tanks are used for storage, equalization, mixing, and aeration of the septage prior to further treatment. Such holding facilities allow a controlled outflow of septage to downstream treatment processes to prevent hydraulic and organic shock loading. Holding tanks function to equalize flows and attenuate variations in septage characteristics among loads. A holding facility is necessary to allow proper metering of septage as a proportion of plant flow.

Provide volumetric holding as necessary to avoid adverse impacts. Holding tanks, if used, should have provisions for interior washdown with chlorinated water or chlorinated secondary effluent after transfer of the septage to the treatment plant is complete.

T1-2.4.2 Flow Control

Flow from the receiving facility to the treatment plant should be controlled. Smaller capacity treatment plants may need variable frequency drive or variable flow pumps, pinch valves or throttling valves, or other devices. These devices can be programmed or manually operated to deliver waste to the treatment plant at times and transfer rates that are not disruptive to the treatment process. Flow control should provide flow volume and velocity to facilitate cleaning pipelines where this may be a problem.

T1-2.4.3 Washwater

Provide a pressurized water supply for adequate washdown of spillage in the unloading area, and for dilution if needed. Water supply may be clean water with appropriate backflow prevention devices or disinfected secondary effluent. Water supply should be capable of providing disinfection. Operators must be able to vary the disinfectant applied to adequately provide for disinfection and odor control.

T1-2.4.4 Odor Control

The design should provide capability to add odor-reducing chemicals to the holding tank, or provide other odor-reducing measures such as activated carbon filters, compost filters, or other odor-scrubbing devices. Odors from septage handling operations should be limited to the same acceptable detection level allowed for the wastewater treatment plant. See Chapter G2 for odor prevention and treatment.

T1-2.4.5 Preliminary Screening and Grit Removal

The receiving facility should be able to screen and recover stones and other nontreatable objects so they do not damage the pumps or grinders. At a minimum, the design should include a provision for sedimentation of rocks and other heavy objects, and access by a vactor truck for periodically recovering those objects.

An additional approach is to provide a separate rock and grit dump facility for haulers to use to purge their vehicles of rock and grit after discharging their waste loads.

T1-2.4.6 Sampling and Flow Recording

The facility should allow access for sampling. Volumetric delivery rates and totals should be recorded by log entries or appropriate flow monitoring devices whenever the facility operates.

T1-2.4.7 Location of Receiving Station

The septage receiving facility should be located in a secure area at or near the treatment area. A water supply and hose bibb must be available so the facility can be hosed down following a delivery. The facility should be under the control of the treatment plant operator and be subject to the same fencing and siting restrictions as the wastewater treatment plant if the facility is not within the plant boundaries. See EPA's "Technology Transfer Handbook—Septage Treatment and Disposal," Chapter 4, 1984 (or latest revision) and WEF's "Manual of Practice No. 24," 1997 (or latest revision), for additional design considerations.

T1-3 References

US Environmental Protection Agency. EPA Technology Transfer. Handbook—Septage Treatment and Disposal. Chapter 4, EPA-625/6-84-009. 1984.

Water Environment Federation. Manual of Practice No. 24. 1997.